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THESIS

LONG RANGE INTER DEPLOYMENT TRAINING
CYCLE SCHEDULE FOR THE P-3 COMMUNITY

by

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September 1996

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The P-3 community consists of 12 Active (effective 01 OCT 96) Maritime Patrol Aviation (MPA) squadrons which deploy to various parts of the world conducting numerous missions. Before deployment, each squadron undergoes a work-up period called the Inter-Deployment Training Cycle (IDTC). The purpose of the IDTC is to adequately prepare a squadron for deployment by conducting training, inspections, and evaluations. A plan is developed to schedule squadron and wing assets effectively to ensure quality training that will improve operational effectiveness on deployment.

The difficulty is developing an IDTC schedule for an individual squadron that has minimal impact on the other eleven squadrons. A schedule that efficiently coordinates a squadron's IDTC improves the effectiveness of a squadron. Moreover, a master schedule that considers the community as a whole will improve the overall effectiveness of the community.

This thesis develops a master schedule for the P-3 community that efficiently schedules an IDTC at the squadron level staying within the desires of the squadron commanders. Additionally, an IDTC shell is incorporated into the employment plans throughout the community avoiding conflicts at all levels. Significant savings are gained by optimally scheduling the NATOPS evaluations.

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FOR THE P-3 COMMUNITY

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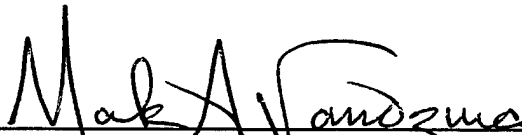B. S., The Pennsylvania State University, 1989

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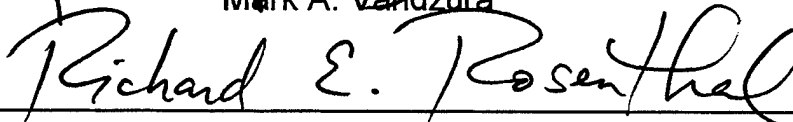
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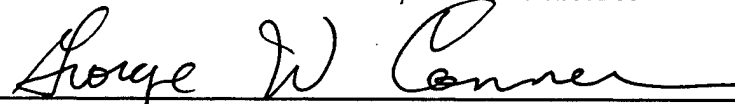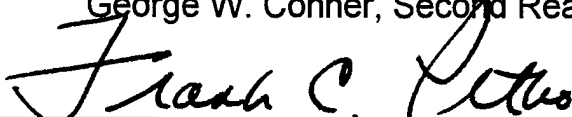
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ABSTRACT

The P-3 community consists of 12 Active (effective 01 OCT 96) Maritime Patrol Aviation (MPA) squadrons which deploy to various parts of the world conducting numerous missions. Before deployment, each squadron undergoes a work-up period called the Inter-Deployment Training Cycle (IDTC). The purpose of the IDTC is to adequately prepare a squadron for deployment by conducting training, inspections, and evaluations. A plan is developed to schedule squadron and wing assets effectively to ensure quality training that will improve operational effectiveness on deployment.

The difficulty is developing an IDTC schedule for an individual squadron that has minimal impact on the other eleven squadrons. A schedule that efficiently coordinates a squadron's IDTC improves the effectiveness of a squadron. Moreover, a master schedule that considers the community as a whole will improve the overall effectiveness of the community.

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EXECUTIVE SUMMARY

The P-3 community consists of 12 Active (effective 01 OCT 96) Maritime Patrol Aviation (MPA) squadrons which deploy to various parts of the world conducting numerous missions. Before deployment, each squadron undergoes a work-up period called the Inter-Deployment Training Cycle (IDTC). The purpose of the IDTC is to adequately prepare a squadron for deployment by conducting training, inspections, and evaluations. A plan is developed to schedule squadron and wing assets effectively to ensure quality training that will improve operational effectiveness on deployment.

This thesis develops a master schedule for the P-3 community that efficiently schedules an IDTC at the squadron level staying within the desires of the squadron commanders. The difficulty is developing an IDTC schedule for an individual squadron that has minimal impact on the other eleven squadrons. A schedule that efficiently coordinates a squadron's IDTC improves the effectiveness of a squadron. Moreover, a master schedule that considers the community as a whole will improve the overall effectiveness of the community.

The problem of finding the most efficient IDTC schedule that has minimal impact on all other squadrons is addressed in two steps. First, generation of an efficient IDTC at the squadron level provides a generic shell that can be placed into the rotation cycles for the wing, coast, and community. Second, as the shell is incorporated into the master schedule via rotation cycles, conflicts are resolved while the overall efficiency of the resources is considered.

This thesis proposes an efficient long range IDTC schedule that is flexible enough to minimize extraneous workload when unplanned lapses occur. An even workload throughout the IDTC affords all squadrons with the ability to assist a sister squadron without overburdening themselves due to an increased operations tempo. Any squadron should be able to assist because no squadron is overtasked.

The principles used in developing a solution to this problem are very simple, yet when combined, a synergistic effect is obtained. The two main principles that drive the solution are identifying the period that drives the problem and keeping the big picture in view with respect to the interaction at all levels.

Specifically, every eighteen months a squadron starts a new cycle. However, due to a PERSTEMPO of 2:1, every six months a new squadron deploys at the wing level. Although we are actually scheduling the requirements during the twelve month period between deployments, the deployment period itself drives the solution. In other words, the fact that there is a requirement for continuous coverage in six month increments actually drives the solution.

The relationships at the wing and coast level are governed by the employment cycles for the respective coasts. The logical progression of cycling one squadron per wing on deployment affords each wing the opportunity to avoid a situation where there is excessive competition for resources.

Except for the NATOPS Evaluations, the east and west coasts are essentially independent. The fact that the east and west coasts are exactly three months out of phase is exploited to minimize competition for NATOPS evaluators. This allows the rotation of NATOPS Evaluations to cycle optimally.

Optimal scheduling of NATOPS Evaluations in the proposed schedule will save 8 trips or 31% of currently scheduled evaluations over a three year period. This translates into significant savings in transportation costs to and from Jacksonville. If traveling by P-3, savings of over $193,000 are expected while commercial travel will save over $28,000.

Additionally, a uniform schedule throughout the community will ensure standardization and increase the ability of squadron commanders to plan for future events with confidence. This improves quality of life for personnel as knowing what to expect is more enjoyable and improves morale. The principles used to generate the solution can be used as a planning tool for other MPA squadrons where possible decisions for employment plans are considered.

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DEDICATION

I would like to dedicate this thesis to a few very special persons for whom this thesis owes an immeasurable debt of gratitude. My family. First, the newest addition to the family, Joshua. He has given me the opportunity to enjoy many diaper changes and coos that I missed due to a deployment immediately after the birth of my first son. Second, Zachary, he has kept everything in perspective by dutifully encouraging me to pitch countless baseballs to him. Life through his eyes has been very rewarding and will be cherished always. But especially my wife, Deb. She has done it all for the family, unselfishly sacrificing her time for ours, offering encouragement and ensuring I had every opportunity to complete this work. Without her patience and understanding, this project would not have happened.

I. INTRODUCTION

The P-3 community consists of 12 Active (effective 01 OCT 96) and 11 Reserve Maritime Patrol Aviation (MPA) squadrons distributed across the United States and Hawaii. This thesis addresses the 12 Active squadrons, which are based out of Brunswick, ME, Jacksonville, FL, Whidbey Island, WA, and Barbers Point, HI. Each squadron deploys for a six month period to various parts of the world conducting numerous missions. These missions include all weather Anti-Submarine Warfare (ASW), surveillance, Anti-Surface Warfare (ASUW), mining, and Command, Control, Communication, and Intelligence (C^{3}I) operations.

Before deployment, each squadron undergoes a work-up period called the Inter-Deployment Training Cycle (IDTC). The purpose of the IDTC is to adequately prepare a squadron for deployment by conducting training, inspections, and evaluations. The plan that is developed, called the CONUS Training Plan, is a guide to schedule squadron and wing assets effectively to ensure quality training that will improve operational effectiveness on deployment.

A. THE PROBLEM

In today's volatile and demanding world, and in light of current budgetary considerations, it is important to do more with less and operate as efficiently and effectively as possible. At the squadron level, resources must be efficiently managed during the IDTC to produce the best trained and qualified crews that resources will allow. Beyond the squadron level, shared resources at the wing, coast, and community level must be considered to make the community as a whole efficient in allocating its resources.

The difficulty is developing an IDTC schedule for an individual squadron that has minimal impact on the other eleven squadrons. A schedule that efficiently coordinates a squadron's IDTC improves the effectiveness of a squadron. Moreover, a master schedule that considers the whole community will improve the overall effectiveness of the community.

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1. Definition of Terms

A brief summary of important terms is necessary to enlighten those readers not familiar with the P-3 Community.

- **Inter-Deployment Training Cycle (IDTC)** -- The period between deployments in which squadrons train and prepare for the next deployment. Generally, deployments last 6 months and IDTCs last 12 months.

- **Tactical Proficiency Course (TPC)** -- A crew level training curriculum that enhances aircrew performance over a wide range of MPA mission areas. (There are 13 crews in each squadron.)

- **Naval Air Training and Operational Procedures Standardization Evaluation (NATOPS)** -- A flight standardization evaluation of a squadron to ensure effective safe utilization of the P-3 aircraft to conduct various missions. Administered by VP-30 based out of Jacksonville, FL.

  -- Full NATOPS is valid for 12 months.

  -- Interim NATOPS is valid for 6 months.

- **Pre-Mining Readiness Certification Inspection (Pre-MRCI)** -- An inspection, conducted by the wing, of mining knowledge and proficiency.

- **Mining Readiness Certification Inspection (MRCI)** -- Similar to the Pre-MRCI except that the inspection is conducted by AIRLANT.

- **Operational Readiness Evaluation (ORE)** -- Evaluates the capability of a squadron to perform assigned operational missions and tasks. It provides a final measure and validation of the effectiveness of the wing and squadron's training and employment plan before a squadron deploys.

2. Problem Scope

This problem is characterized by two very distinct yet dependent levels. First, the idea of scheduling the squadron level training requires consideration of the major training requirements met by squadrons during the IDTC. Second, after an efficient IDTC is developed, the interaction between squadrons at the wing, coast, and

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community level is evaluated to minimize conflicts while maximizing the effectiveness of the resources allocated.

The normal rotation for a squadron is to deploy for six months then train for the following twelve months for the next deployment. The IDTC, or twelve month period between deployments, can be separated into two six-month intervals called the beginning of the IDTC and the end of the IDTC. An example of a generic rotation cycle is depicted in Table 1. Notice that each period represents six months and DEP = Deployed, BEG = Beginning of IDTC, and END = End of IDTC.

Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7
DEP	BEG	END	DEP	BEG	END	DEP
DEP	**IDTC**		**DEP**	**IDTC**		**DEP**

Table 1. Generic Squadron Rotation Cycle. Each period is six months long.

During an IDTC the squadrons go through the TPC process, conduct an Interim and a Full NATOPS Evaluation, a Pre-MRCI, a MRCI, and an ORE. At this level, a squadron's IDTC is considered independently of the other eleven squadrons. Once an independent schedule is developed, consideration is given to how the wing, coast, and community interact and how best to use resources for the betterment of the community as a whole.

Figure 1, on the following page, is an overview of where the current active MPA squadrons and associated support units are located. VP-11 is due to be decommissioned on 01 October 1996. For purposes of this thesis, a twelve squadron VP force will be assumed along with one Fleet Replacement Squadron (FRS), namely VP-30, located in Jacksonville, FL.
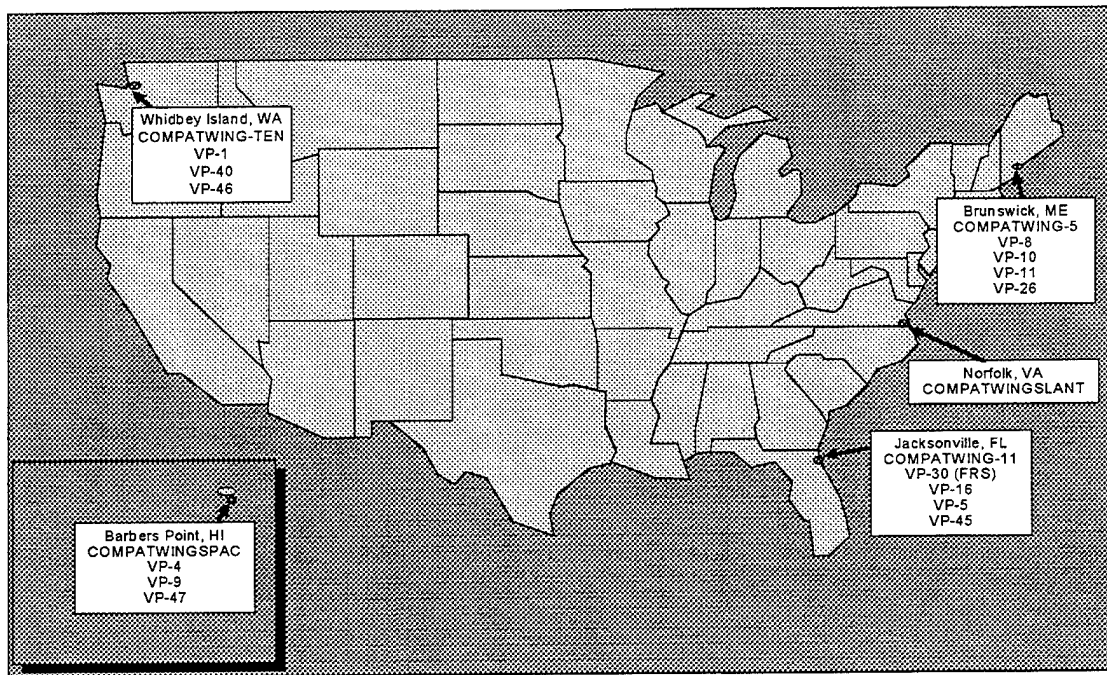
Figure 1. Geography and Structure of the P-3 Community. Wing Five's VP-11 squadron will be decommissioned in late 1996. Wing Eleven's VP-30 is not a deployable squadron; it is used for replacements and evaluations in the other squadrons. Therefore, both the Atlantic and the Pacific have two wings of three squadrons each.

A wing is a group of several squadrons. For example, Wing FIVE consists of VP-8, VP-10, and VP-26. At the wing level, there is one squadron deployed while the other two are either in the beginning or the end of their respective IDTC. Table 2 shows how the individual squadron rotation cycles fit together at the wing level. Because all wings have three squadrons it is important to note that all wings are similar in this manner.

Squadron	Site	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
VP-8	Wing 5	**DEP**	BEG	END	**DEP**	BEG	END
VP-10	Wing 5	END	**DEP**	BEG	END	**DEP**	BEG
VP-26	Wing 5	BEG	END	**DEP**	BEG	END	**DEP**

Table 2. Generic Wing Level Rotation Cycle.

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The two wings on each coast are governed by their respective Commanders, namely Commander Patrol Wings Atlantic (CPWL) on the east coast and Commander Patrol Wings Pacific (CPWP) on the west coast. A generic Coast Rotation Cycle is shown for the east coast in Table 3. This shows that at any given time there are two squadrons per coast that are deployed, two in the beginning, and two in the end of an IDTC. Notice that the wings are in sync with each other. This is a good schedule design because they share deployment sites and can rotate sites between wings.

Squadron	Site	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6
VP-8	Wing 5	**DEP**	BEG	END	**DEP**	BEG	END
VP-10	Wing 5	END	**DEP**	BEG	END	**DEP**	BEG
VP-26	Wing 5	BEG	END	**DEP**	BEG	END	**DEP**
VP-5	Wing 11	**DEP**	BEG	END	**DEP**	BEG	END
VP-16	Wing 11	END	**DEP**	BEG	END	**DEP**	BEG
VP-45	Wing 11	BEG	END	**DEP**	BEG	END	**DEP**

Table 3. Generic Coast Rotation Cycle for the East Coast.

As we piece together the east and west coast rotation cycles, notice that the wings on each coast are in sync with each other. The question that remains is how the coast rotation cycles mesh with each other. We can anticipate though, at any given time, there will be four squadrons deployed, four at the beginning of an IDTC and four at the end of an IDTC. Current employment plans for the east and west coast indicate that the east and west coast squadrons are exactly three months out of phase. This implies that every three months the squadrons on one coast transition to the next period according to the Coast Rotation Cycle. As many personnel transfer shortly after deployment, the need for fleet replacements rises at the same time. With one Fleet Replacement Squadron, VP-30, the three month phase ensures an even flow of replacements to the fleet. This symmetric relationship is shown in Table 4. Note that the periods are now in three month increments to illustrate the relationship between the east and west coast.

VP	Site	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10	P-11	P-12
VP-8	ME	BEG		END		DEP		BEG		END		DEP	
VP-10	ME	DEP		BEG		END		DEP		BEG		END	
VP-26	ME	END		DEP		BEG		END		DEP		BEG	
VP-5	FL	BEG		END		DEP		BEG		END		DEP	
VP-45	FL	DEP		BEG		END		DEP		BEG		END	
VP-16	FL	END		DEP		BEG		END		DEP		BEG	

VP	Site	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10	P-11	P-12	P-13
VP-1	WA		DEP		BEG		END		DEP		BEG		END	
VP-40	WA		END		DEP		BEG		END		DEP		BEG	
VP-46	WA		BEG		END		DEP		BEG		END		DEP	
VP-4	HI		DEP		BEG		END		DEP		BEG		END	
VP-9	HI		END		DEP		BEG		END		DEP		BEG	
VP-47	HI		BEG		END		DEP		BEG		END		DEP	

Table 4. Community Rotation Cycle. Illustrates 3-month Phase Shift Between Coasts.

3. Competition for Resources

Resources are those entities that are used or allocated in the execution of training, evaluations, and/or inspections. Specifically, they include various inspection teams and availability of mining ranges. Determination of an efficient schedule for training, evaluation, and inspection events includes no consideration of conflicts among shared resources. The focus is in developing an efficient IDTC plan for one squadron.

Given an efficient IDTC schedule shell, examination of potential conflicts among shared resources at all levels will determine feasibility based on current rotation cycles. Potential conflicts are determined by inspector and range availability which is dependent upon the level of the inspection or evaluation to be administered. The following indicates the requirements and associated level of potential conflicts.

- TPC - No conflicts at any level.
- NATOPS - Only one inspection team administers the NATOPS evaluations, so potential conflicts are at the wing, coast, and community level.
- Pre-MRCI - This is a wing level inspection, however the mining range is shared by squadrons on each coast.
- MRCI - The inspectors and range are shared at the coast level.
- ORE - This evaluation is conducted at the wing level.

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The NATOPS evaluations have the most demand because VP-30 is the only unit that conducts the NATOPS evaluations. The MRCIs incur coast level conflicts due mainly to range availability. The ORE has wing level implications. A summary of the potential resource conflicts is given in Table 5.

Requirements	Wing	Coast	World
TPC	0	0	0
NATOPS full	1	1	1
NATOPS interim	1	1	1
Pre-MRCI inspector	1	0	0
Pre-MRCI range	0	1	0
MRCI inspector	0	1	0
MRCI range	0	1	0
ORE inspector	1	0	0

Table 5. Summary of Potential Conflicts.

B. CURRENT PROCEDURES

The following discussion is based on information contained in the Training Readiness Manual COMPATWINGSLANTINST 3500.24E.

Commanders on the east and west coasts provide guidance for numbered Wing Commanders and squadron Commanding Officers to help them achieve the highest state of readiness within the limitations of time and available resources. This guidance comes in the form of the Training Readiness Manual (TRM). This instruction lists all operational missions assigned to the VP squadrons and identifies the training evolutions needed to meet the mission capability requirements set forth by the CNO and Fleet/Type Commanders.

1. IDTC Promulgation

The TRM requires that each squadron shall develop a training plan for the IDTC prior to its return from deployment. The first phase of the training program should begin when a squadron returns from deployment. During this initial phase, emphasis

should focus on the upgrade training to allow newly formed crew members to gain experience, improve crew coordination, and build confidence. As crews become TPC qualified, their training should focus on advanced qualifications and tactical proficiency with combat readiness increasing as the squadron prepares to deploy. The primary objectives of the TRM are to ensure:

- Optimal asset utilization.
- Crew integrity.
- A balanced learning environment.
- Highest possible quality of life.
- The highest degree of squadron combat readiness given current resource constraints.

Additionally, the Wing commanders are tasked to promulgate a consolidated long range training and employment plan which includes all assigned squadrons. At a minimum, scheduled activities in the plan shall include:

- Squadron deployments and known detachments.
- Transitions.
- Host squadron duties.
- Annual NATOPS evaluations.
- Mine Readiness Certification Inspections.
- Command Inspections.
- ORE schedule.

2. Conflict Resolution

Respective wings conduct scheduling conferences to ensure maximum coordination of training opportunities and operational commitments. Priority is given to the operational duty squadron. Order of priority for the remaining squadrons is determined by deployment schedules, with preference given to the next squadron to deploy.

The Pre-MRCI and ORE pose potential conflicts at the wing level. Wing Commanders deconflict schedules under the above guidance. The MRCI range and inspection team present potential conflicts at the coast level and are generally handled by individual Mining representatives on each coast.

VP-30 schedules NATOPS Evaluations on a first come first serve basis. A large effort is made to pair up evaluations at the various sites to avoid unnecessary trips. Again, prior knowledge of when a squadron is due for an evaluation and known deployment cycles assist in determining both Interim and Full NATOPS Evaluations.

3. Contingency Planning

Sometimes unexpected commitments arise and force changes into the long range plan. When circumstances warrant action, all efforts are made to adhere to mandated requirements. Suppose a squadron fails to meet set standards and must delay beginning a deployment. All available assets will be utilized to their fullest potential to share any undue burdens until matters return to a stable condition.

This thesis proposes an efficient long range IDTC schedule that is flexible enough to minimize extraneous workload when unplanned lapses occur. An even workload throughout the IDTC affords all squadrons with the ability to assist a sister squadron without overburdening themselves due to an increased operations tempo. Any squadron should be able to assist because no squadron is overtasked.

II. DEVELOPMENT OF PROPOSED IDTC SCHEDULE

The problem of finding the most efficient IDTC schedule that has minimal impact on all other squadrons is addressed in two steps. First, generation of an efficient IDTC at the squadron level provides a generic shell that can be placed into the rotation cycles for the wing, coast, and community. Second, as the shell is incorporated into the master schedule via rotation cycles, conflicts are resolved while the overall efficiency of the resources is considered.

A. ASSUMPTIONS

The following assumptions are made and must be considered in understanding the manner in which the proposed IDTC schedule is generated. The problem scope dictates the level of the assumptions.

1. A rotation cycle of six months deployed followed by twelve months at home.
2. Leveling of workload is desired throughout the IDTC.
3. Squadron designated prerequisites are acceptable, but placement throughout IDTC timeline is variable.
4. Pre-deployment and post-deployment leave periods last four weeks.
5. Squadrons go to 50% manning over the Christmas holidays.
6. Each requirement takes a certain number of weeks as per Table 6.

Requirements	Weeks to Prepare	Weeks for Inspection
TPC	29	0
NATOPS (I)	4	1
NATOPS (F)	4	1
Pre-MRCI	4	1
MRCI	4	1
ORE	5	1

Table 6. Combined preparation and execution time required per event.

B. LITERATURE REVIEW

Cyclic scheduling deals with a set of routines that occur over and over again. Usual scheduling constraints may be considered: precedences, resource sharing, deadlines, etc.; however, these constraints must be formulated "generically". This means that the same routine cycles over a particular frequency. Cyclic scheduling is often used for 24-hour per day staffing.

The Northeast Tollway Staffing Problem out of Chicago has a toll plaza with various demands during a 24-hour period (Schrage, 1991). The demand changes throughout the day, but repeats every 24 hours. Once an optimal solution is found for one day it can be used again for the next day and the next and so on.

Similar types of staffing problems for nurses (Maier-Rothe, 1973 and Rosenbloom, 1987) describe how to develop schedules for shift work. In addition to ensuring that adequate skill levels are maintained throughout each day, rotation of personnel through each of the three shifts is addressed.

More advanced discussions (Hanen, 1994) involve particular instances of cyclic scheduling on parallel processors. From everyday staffing problems to complex computer algorithms, cyclic scheduling has many real world applications.

C. PRINCIPLES UTILIZED

The principles used in developing a solution to this problem are very simple, yet when combined, a synergistic effect is obtained. The two main principles that drive the solution are identifying the period that drives the problem and keeping the big picture in view with respect to the interaction at all levels.

Specifically, every eighteen months a squadron starts a new cycle. However, due to a PERSTEMPO of 2:1, every six months a new squadron deploys at the wing level. Although we are actually scheduling the requirements during the twelve month period between deployments, the deployment period itself drives the solution. In other words, the fact that there is a requirement for continuous coverage in six month increments actually drives the solution.

The relationships at the wing and coast level are governed by the employment cycles for the respective coasts. The logical progression of cycling one squadron per wing on deployment affords each wing the opportunity to avoid a situation where there is excessive competition for resources. For example, if two squadrons were deployed from Wing Eleven, then there would be one squadron in Jacksonville, vying for simulator time, while in Brunswick, there would be three squadrons competing for simulator time.

Except for the NATOPS Evaluations, the east and west coasts are essentially independent. The same train of thought, minimizing competition for resources, is exploited by the fact that the east and west coasts are exactly three months out of phase. This fact allows the rotation of NATOPS Evaluations to cycle optimally as we shall see.

1.   Identifying Issues

Current doctrine provides sound guidance with respect to the general flow of the IDTC. As squadrons return home from deployment, combat air crews reform as crew members transfer in and out of the squadron. The first phase of the IDTC concentrates on the TPC process. Then, as crew members become more experienced, they prepare for the inspections and evaluations during the second half.

The issues are defined by the underlying problem of coordinating the training, inspections, and evaluations in a manner that best utilizes limited resources for the entire community. An attempt is made to give the squadron commanders what they want during the IDTC while improving the overall efficiency of the P-3 community.

An even workload is desired throughout the IDTC. The work up period should be consistent in the operations tempo avoiding peaks and valleys in workload, which imply inefficiencies. A steady rate of work also improves quality of life by minimizing periods of unusually arduous duty. Additionally, by spacing out events efficiently and making earnest efforts to adhere to the plan, higher levels of morale can be maintained by allowing squadron members the luxury of knowing what to expect in upcoming months.

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Once the ideal IDTC shell is built, an evaluation of the placement of 'events' with respect to the other squadrons is considered to avoid any conflicts caused by shared resources. Conflicts can occur at all levels and are dependent upon timing and the resource needed. For example, an inspection team cannot be at two places at the same time.

Once the conflicts are resolved, focus turns to areas of potential savings. Specifically, VP-30 visits all four wings and careful scheduling of NATOPS Evaluations can drastically cut back on unnecessary flights to and from the various sites.

2.   Developing Constraints

A problem of this size has many constraints that must be adhered to. The following constraints are adhered to while developing an ideal IDTC schedule for one squadron as well as implementing it into the various levels.

1. Every squadron must complete every requirement exactly one time.
2. Some requirements are dependent on inspectors or range availability.
3. Inspectors can only conduct one evaluation at a time.
4. Ranges can only be used by one squadron at a time.
5. Squadrons are limited in the number of flight and simulator events conducted per week.
6. A level workload is desired throughout the IDTC for all squadrons.
7. Squadrons on deployment are not available for IDTC scheduling.
8. Squadrons will have reduced workloads just prior to and just after deployment.
9. There is a reduced workload during Christmas holidays.
10. PERSTEMPO is 2:1, but is governed by deployment schedules.
11. TPCs are scheduled immediately following deployment.
12. Either NATOPS Evaluation can be scheduled concurrently with TPC.
13. Only one NATOPS Evaluation can be conducted at any time.
14. Only one Pre-MRCI or MRCI per coast can be conducted at any time.

3.   Schedule Development

The IDTC shell is developed by first determining the feasible time periods when training, inspections, and evaluations can be scheduled. Four weeks of post deployment leave at the beginning of the IDTC and four weeks of pre deployment leave

at the end of the IDTC are set aside. Squadrons are at 50% manning, and because the TPC process only involves a few crews at a time throughout the IDTC, the TPC process can start as early as week three.

There are two types of NATOPS evaluations that are valid for different amounts of time. The Full NATOPS is valid for twelve months after satisfactory completion and the Interim NATOPS is valid for six months, totaling eighteen months. Coincidentally, every eighteen months a squadron begins a new IDTC. Because no evaluations are conducted on deployment, the Full NATOPS evaluation must be valid over a squadron's deployment. This implies that the Interim evaluation must be done before the Full and they must be six months apart so the entire eighteen month cycle from IDTC start to IDTC start is covered.

With guidance from the wing commanders and the desired ordering of events, the remaining requirements are placed into the IDTC shell. The spacing between events is determined by the number of weeks needed to prepare for and execute the training, inspection, and evaluation events. Leveling of workload and quality of life issues are considered. An additional stipulation is that the TPC process of qualifying crews can be conducted concurrently with the Interim NATOPS Evaluation and the Pre-MRCI.

In light of the above, Figure 2 shows the ideal IDTC shell in that it represents the best placement for the requirements closest to what the commanders desire while considering leveling of workload. Each six month period is broken down into twenty-six weeks and the associated requirements are placed accordingly. Once complete, the periods are labeled into one month periods, for ease of understanding, as the IDTC shell is implemented at the various levels of rotation cycles.

Figure 2. Generic IDTC Shell Development.

Next, the IDTC shell is tested for validity at the wing level. Based on similar ordering of events for each squadron and because there is one squadron deployed, one squadron at the beginning of the IDTC and one at the end of the IDTC, there are no conflicts at the wing level except possibly with the NATOPS evaluations. The only conflict is with two squadrons at the same wing attempting to conduct an Interim and a Full NATOPS Evaluation at the same time. This is easily resolved because there are four weeks per month, so the evaluations are scheduled in consecutive weeks. It is important to note that when the NATOPS evaluations are scheduled in consecutive weeks this passes a savings to VP-30 by not having to make an extra trip to that wing.

At the coast level, there are two squadrons deployed, two squadrons at the beginning of the IDTC and two at the end of the IDTC. Squadrons on the same coast share a mining range and mining inspectors, however the two squadrons that are conducting the mining inspections can do so in the same month. The NATOPS conflict compounds when combining two wings on the same coast. However, it is feasible to

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schedule four evaluations in the same month by keeping the evaluations in consecutive weeks for squadrons in the same wing.

Finally, combining the east and west coast squadrons, the only potential conflict is with the NATOPS evaluations. But, due to the east and west coasts being three months out of sync, the NATOPS evaluations do not conflict at this level.

Finishing touches include avoiding inspections and evaluations over the Christmas holidays and designing the NATOPS evaluations in accordance with the desires of VP-30. Depending on the Fleet NATOPS team, there are a few options they can consider based on the quality of life they desire. For example, they might evaluate the west coast squadrons in four consecutive weeks or evaluate one wing, return home for two weeks, then evaluate the other wing.

III. RESULTS AND CONCLUSION

A. RESULTS

This thesis proposes a useful long range IDTC schedule that effectively utilizes resources throughout the P-3 community. Table 7 shows the recommended IDTC schedule for a three year period beginning in May of 1997. This date was chosen because it coincides with a coast employment plan and, by this time, it is possible for all NATOPS evaluations to become in sync with the master schedule. Essentially, the shell for an IDTC provides a schedule for all squadrons that maintains a level workload throughout the IDTC. When integrated into the community, the long range schedule also provides substantial savings by VP-30's Fleet NATOPS team while minimizing conflicts among shared resources. The total number of NATOPS Evaluations and trips are given in Table 7 to show workload for Fleet NATOPS evaluators and anticipated travel requirements. Potential bonus savings occur when west coast evaluations are scheduled consecutively vice making two separate trips to the west coast.

		YEAR	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	9	9	9	9	9	9	9	9	9	9	9	0	0	0	0
		MONTH	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A
EAST	VP-8		T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	T	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	T	T	TI
Wing 5	VP-10		D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D
ME	VP-26		M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F
EAST	VP-5		T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI
Wing 11	VP-45		D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D
FL	VP-16		M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F
WEST	VP-1		D	D	D	D	D	D	T	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L
Wing 10	VP-40		T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T
WA	VP-46		LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D
WEST	VP-4		D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L
Wing 2	VP-9		T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T
HI	VP-47		LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D	LT	T	TI	T	T	T	T	P	F	M	O	L	D	D	D	D	D	D
		MONTH	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A
		YEAR	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8	8	8	8	9	9	9	9	9	9	9	9	9	9	9	9	0	0	0	0
48	NATOPS		0	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	4	0	0	4
18	TRIPS		0	0	2*	0	0	1	0	0	2*	0	0	1	0	0	2*	0	0	1	0	0	2*	0	0	1	0	0	2*	0	0	1	0	0	2*	0	0	1

D = Deployed   T = TPC   I = Interim NATOPS   P = Pre-MRCI   * = Potential Bonus Savings

L = Leave   O = ORE   F = Full NATOPS   M = MRCI

Table 7. Recommended Long Range IDTC Schedule.

1. NATOPS Optimality

In analyzing the value of this proposed schedule, it is necessary to evaluate just how good the solution can be. Let us consider the measure of effectiveness to be the number of trips the NATOPS Evaluation team must make per eighteen month cycle. During one cycle, every squadron will be required to conduct two NATOPS Evaluations, for a total of twenty-four evaluations. Of those twenty-four, six will be in Jacksonville for Wing 11, leaving 18 evaluations that require transportation, per diem, and time away from home. In the worst case, the evaluation team would have to take 18 trips. With better planning, fewer trips are possible. What is the smallest number feasible?

At the wing level, six evaluations will be necessary. Because at any given time there will be one squadron deployed, the NATOPS team can evaluate at most two squadrons per wing visit. This implies that it will take at least three trips per wing per eighteen month cycle. (six evals / max of two evals per visit) Three wings require trips by the NATOPS team times three trips implies that it will take a minimum of nine trips to evaluate the P-3 community in one eighteen month cycle.

In other words, in the best case, the NATOPS team could perform two evaluations on each wing visit, making a total of nine trips per cycle; or exactly half as many visits as the worst case. If the best case bound of nine trips per 18 months is achieved, it must be optimal. The proposed solution covers 36 months and has 18 trips so it indeed optimal. Therefore, you can do no better than the proposed schedule, from the point of view of minimizing the cost of NATOPS Evaluations.

The current procedure is to extrapolate the current NATOPS Evaluation schedule over a three year period while considering deployment cycles. Based on the current schedule, a three year period would require 26 trips. Based on this number of trips required, the proposed schedule will save 8 trips or 31%. This translates into significant savings in transportation costs to and from Jacksonville. If traveling by P-3, savings of over $193,000 are expected while commercial travel will save over $28,000.[1]

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[1] The savings are based on flight costs used by the Fleet NATOPS Department of VP-30. It costs $562 an hour to fly a P-3C to any site. A trip to HI (28 hour round trip) costs $15,736, a trip to WA (15 hours) cost $8,430, and a trip to ME (8 hours) costs $4,496. Commercial air fare per person cost $725 to HI, $450 to WA, and $385 to ME. Ten personnel are required when one evaluation is administered at a site while fourteen are required if two evaluations are administered. Based on the current schedule, the proposed schedule saves four trips to HI and four trips to WA over a three year period.

The decision to fly by P-3 or commercial air is based upon available funds at the time of the evaluation so exact savings are difficult to predict. Essentially, the same amount of money is spent on per diem and lodging because the number of evaluations per cycle does not change. However, contrary to current procedures, the proposed schedule ensures that a Full NATOPS Evaluation lasts for 12 months vice conducting another evaluation a month or two before the current one expires. Likewise for the Interim NATOPS Evaluation, the renewal occurs during the expiration month.

B. CONCLUSION

Based on the proposed long range IDTC schedule, there are significant savings available by efficiently scheduling the NATOPS Evaluations. Even though there are subtle differences in the way the two coasts prepare for deployments, those differences do not impact these savings.

Moreover, depending on how VP-30 perceives these recommendations, there are different ways in which savings could be increased. For example, a four week trip to Hawaii and Washington could be condensed into three weeks if the Interim NATOPS Evaluations were sandwiched in between the Full NATOPS Evaluations. This would require a policy change, but is mentioned to elicit discussion of more potential ways to increase savings.

IV.   SUMMARY AND RECOMMENDATIONS

A.   SUMMARY

The purpose of the IDTC is to adequately prepare a squadron for deployment by conducting training, inspections, and evaluations. A plan is developed to schedule squadron and wing assets effectively to ensure quality training that will improve operational effectiveness on deployment. Beyond the squadron level, shared resources at the wing, coast, and community level must be considered to make the community as a whole efficient in allocating its resources.

The difficulty is developing an IDTC schedule for an individual squadron that has minimal impact on the other eleven squadrons. A schedule that efficiently coordinates a squadron's IDTC improves the effectiveness of a squadron. Moreover, a master schedule that considers the community as a whole will improve the overall effectiveness of the community.

This thesis develops a master schedule for the P-3 community that efficiently schedules an IDTC at the squadron level staying within the desires of the squadron commanders. Additionally, an IDTC shell is incorporated into the employment plans throughout the community avoiding conflicts at all levels. Due to the employment plans significant savings was gained by optimally scheduling the NATOPS evaluations.

B.   RECOMMENDATIONS

Based upon the assumptions described within, I recommend that the long range IDTC schedule be implemented into the fleet as soon as practical. Immediate savings of up to 31% fewer trips will be gained with its implementation by optimally scheduling NATOPS Evaluations. The ideas expressed in this thesis have been received with optimism and are under consideration by the Fleet NATOPS Department of VP-30. Based upon the desires of VP-30, other options are available to meet their quality of life requirements.

A uniform schedule throughout the community will ensure standardization and increase the ability of squadron commanders to plan for future events with confidence. This improves quality of life for personnel as knowing what to expect is more enjoyable and improves morale. The principles used to generate the solution can be used as a planning tool for other MPA squadrons where possible decisions for employment plans are considered.

This thesis addresses a macro view of the squadron level training requirements for the community and does not address the numerous other requirements that squadrons must go through during the IDTC. These include maintenance, administrative, and individual level requirements mandated by law and policy.

A micro view of all the requirements a squadron faces during an IDTC could also yield opportunities for research work. For example, a similar type of schedule could be developed for one combat air crew that could be used as a shell for all crews. There are numerous amounts of training, qualification, and proficiency requirements imposed on a combat air crew. Efficient use of each crew's time will improve the efficiency of the squadron as a whole and increase the Maritime Patrol Aircraft community's overall combat effectiveness.

LIST OF REFERENCES

COMPATWINGSLANT INSTRUCTION 3500.24E, "Training Readiness Manual," 07 March 1996.

Hanen, C. and Munier, A., *Scheduling Theory and Its Applications*, Chapter 4., John Wiley & Sons Ltd., 1994.

Maier-Rothe, C. and Wolfe, H.B. "Cyclical Scheduling and Allocation of Nursing Staff," *Sociological Economical Planning Sciences*, v.7, pp. 471-487, 1973.

Rosenbloom, E.S. and Goertzen, N.F. "Cyclic Nurse Scheduling," *European Journal of Operational Research*, v.31, pp.19-23, 1987.

Schrage, L., *LINDO An Optimization Modeling System,* pp. 73-75, The Scientific Press, 1991.

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